DESIGN AND FABRICATION OF STEERING SYSTEM FOR ELECTRIC GO KART

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ABSTRACT

The objective of this project is to design and fabricate the steering system for electric go kart. Usually, majority of the go kart available at the market are based on petrol engine. The functional for this steering system are based on available product which is evaluated by research on the available source such as Internet. The basic part for the steering system such as steering column, track rods and stub axle are being research thoroughly to understand the function of each part. Before the fabrication process, some research for the milling, lathing, drilling and welding process are done to make sure it is suitable for the material used. To obtain the best designs, it has to be parallel with the scope of the project and suited with the criteria needed. Three concepts design are generated and final design are choose based on the Evaluation Table and discussion between team members and supervisor. Material selection is chose by surveying the available raw material from the store. Materials based on mild steel are choose due to its characteristic which can be weld and fabricate easily. Measuring, cutting, drilling, turning, milling, bending, welding, grinding and finishing process are done to complete this project. The final phase of this project is to assemble all the components and parts of the electric go kart fabricate from the team members. The purpose of this project is to allow the driver of go kart to change the direction during handling.

ABSTRAK

Objektif projek ini adalah untuk merekabentuk dan membina sistem stereng untuk go kart elektrik. Biasanya, majoriti go kart boleh didapati di pasaran adalah berteraskan kepada enjin petrol. Berfungsi untuk sistem stereng ini adalah berdasarkan pada produk yang ada dipasaran dan diselidik melalui sumber yang ada seperti Internet. Komponen asas bagi sistem stereng seperti kolum stereng, rod trek dan gandar puntung telah diselidik dengan teliti untuk memahami fungsi setiap bahagian. Sebelum proses pembinaan, beberapa kajian untuk proses milling, lathing, penggerudian dan kimpalan dilakukan untuk memastikan ia sesuai untuk bahan yang digunakan. Untuk mendapatkan reka bentuk yang terbaik, ia perlu selari dengan skop projek dan sesuai dengan kriteria yang diperlukan. Tiga reka bentuk konsep telah dihasilkan dan konsep terakhir dipilih berdasarkan kepada Jadual Penilaian dan sesi perbincangan diantara ahli kumpulan dan penyelia. Pemilihan bahan dipilih dengan meninjau di stor bahan mentah. Bahan mentah yang berteraskan keluli lembut telah dipilih kerana ciri-cirinya yang senang dikimpal dan senang diproses. Proses mengukur, memotong, menggerudi, melarik, milling, membengkok, mengimpal mencanai dan proses penutup. Langkah terakhir untuk projek ini ialah menyambung semua komponen dan bahagian-bahagian go kart elektrik yang telah dibuat oleh ahli kumpulan yang lain.Tujuan utama projek ini adalah untuk membolehkan pemandu untuk mengubah haluan go kart elektrik semasa memandu.

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LIST OF SYMBOLS

mm	Millimeter
RPM	Revolution per minute

LIST OF ABBREVIATIONS

IFK	International Kart Federation
HPS	Hydraulic Power Steering
FYP	Final Year Project
MIG	Metal Inert Gas
UMP	Universiti Malaysia Pahang
PIC	Person in charge

CHAPTER 1

INTRODUCTION

1.0 PROJECT BACKGROUND

This chapter explained about the problem statement, objectives of the project, and the methodology of this project. The methodology covers the flow of the project and progress of the project.

1.1 PROBLEM STATEMENT

Majority of go kart available in the market are using a small 2 stroke or 4-stroke engines. Electric go karts are also available, but hardly to be seen. Spare parts for the steering system are also hard to purchase in Malaysia. This is because go kart are only played by a citizen in the urban place such as big city. Price for buying go kart is also high.

1.2 OBJECTIVES OF THE PROJECT

The objective for this project is to design and fabricate the steering system for an electric go kart.

1.3 SCOPES OF THE PROJECT

This project is focusing on the design and fabrication of steering system for an electric go kart. This focus area is done based on the following aspect:

(i) The wheel can be steered parallel to the both side of the tire.

(ii) The steering inclination angle should be suitable to the driver's hand.

(iii) The steering system can be assembled with scope dimension of Aslam's chassis.

1.4 PROJECT PLANNING

Figure 1.1 shows the flow chart for this project. From the beginning until the end of the project, the sequences are followed through this flow chart.

Firstly, the project titles are discussed with the consultation of the project's supervisor. A lists of problem statement are listed, before deciding the suitable title, thus the objective and scope are decided. Then, literature reviews are done to guide the flow of this project.

After the main problem was identified, conceptual designs are generate based on the scope of the project. The best designs are selected for the final design.

When the final design are decided and approved, the fabrication process started. Schematic dimensions from the final design are used during the fabrication process. All material defined early to ensure its availability in the mechanical store.

During the fabrication process, closed supervision from the project supervisor are important in order to gets the improvement during the process. The best recommendations which give a better performance will be proposed for this project.

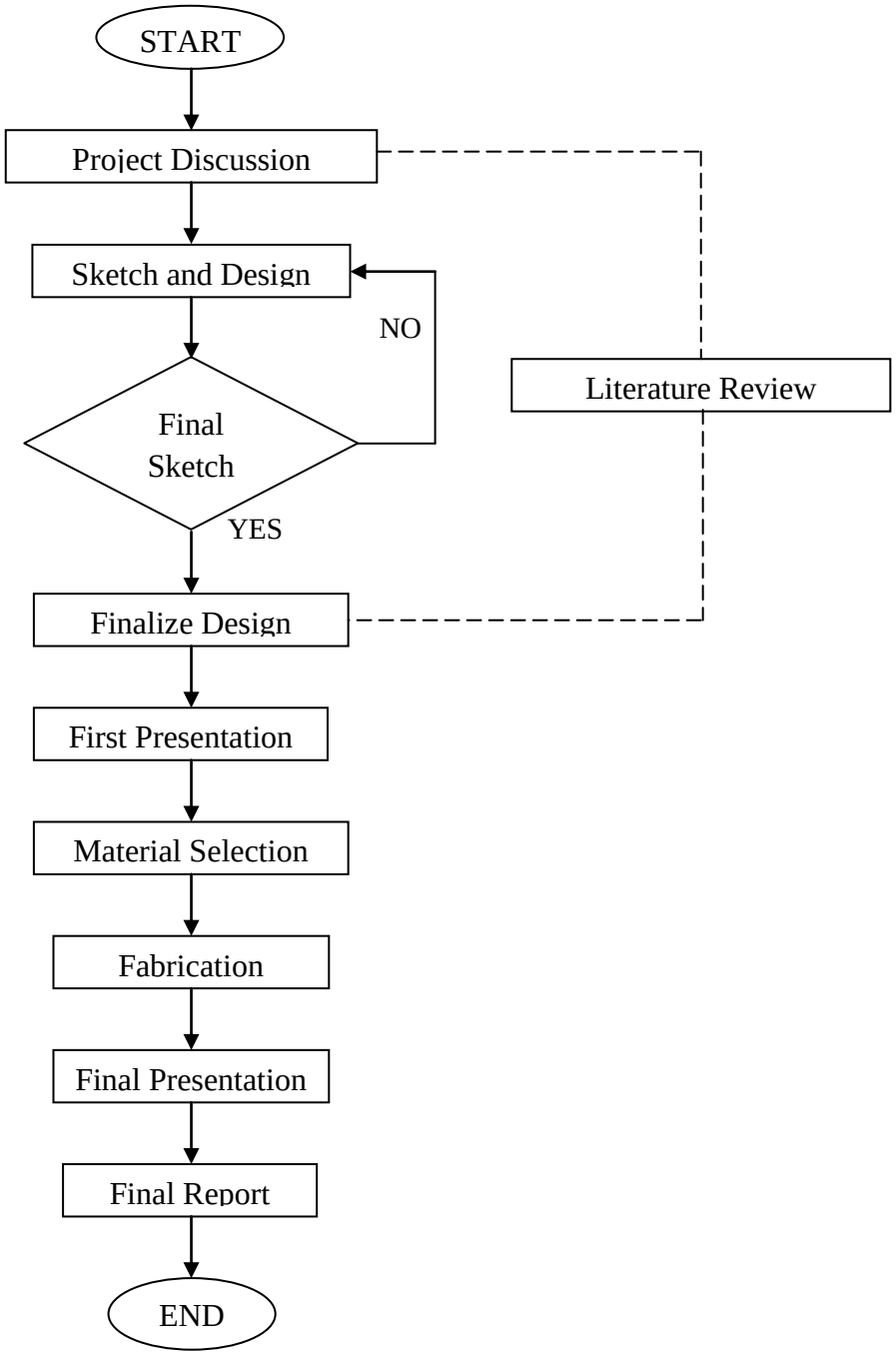

Figure 1.1: Project Flow Chart

Figure 1.2 below show the Gantt chart for this project respectively. The duration of time needed for the whole project is shown for the reference scheduled.

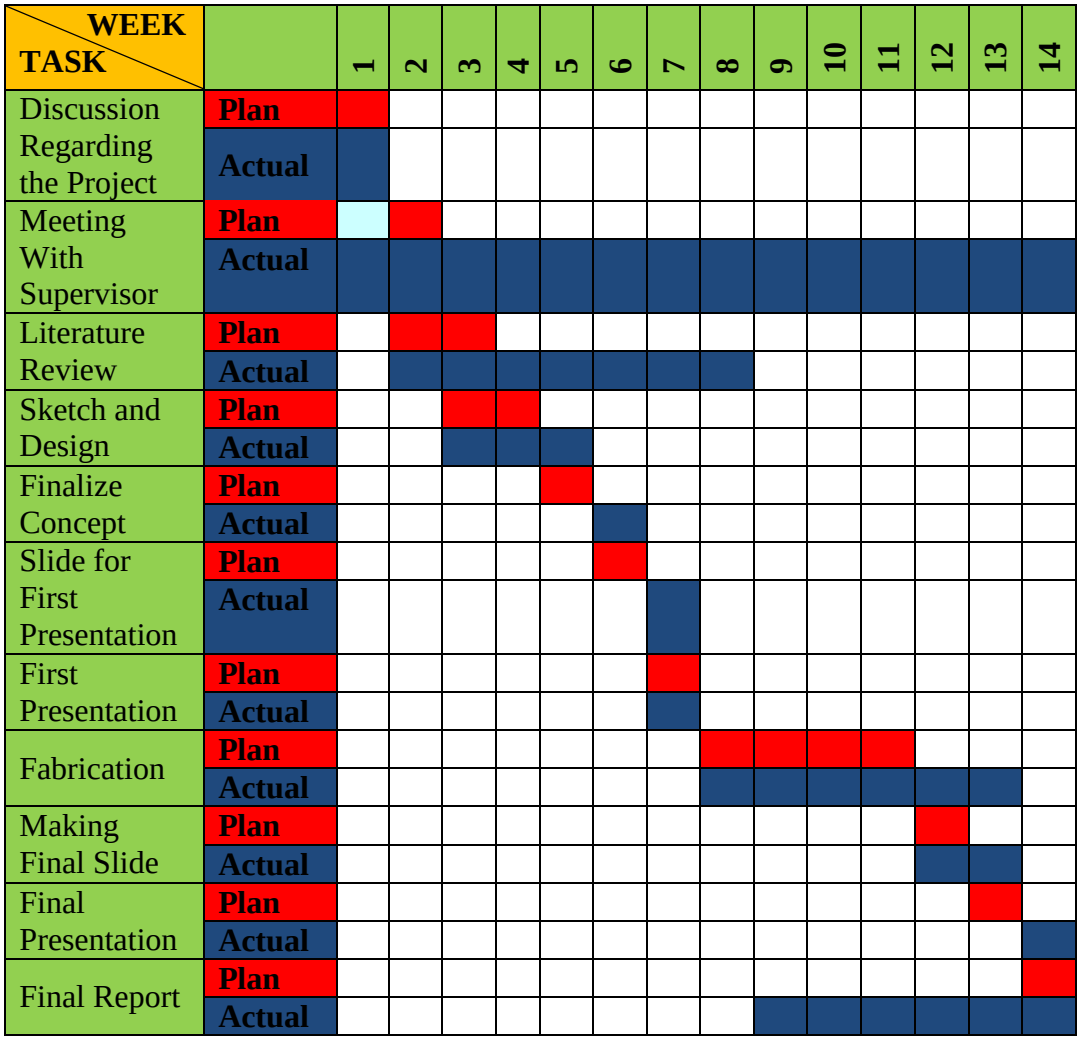

Figure 1.2: Project Gantt Chart

Based on the Gantt chart, the title has been discussed and confirmed by the supervisor at week 1. Thus, the literature has been researched until week 8. Meeting with the supervisor are held every week during this semester to report the progress about this project.

Sketching of concept designs are done during week 3 to 5, one week late from the planning because of the problem occurred, especially when to decide the suitable

process for the crucial parts. In week 6, the final design are produced and approved for the fabrication process.

In week 7, mid presentation are held as planned. Preparation are done a week on the same week due to the problem with the concept designs. After the mid presentation, fabrication process is started at week 8 until week 13. The process takes times because of the limitation used in milling machine and lack of tools in the lab.

The report of this project is planned to start on week 14, but due to the problems, the report start in progress earlier on the week 9. The final presentation is held on week 14, which is late a week from the planning.

1.5 STRUCTURE OF THESIS

Chapter 1 introduces the introduction of this project. It is generally discussed about the background of the project, objectives, scope and the flow of the project. Besides, it tells about the duration to complete this project.

Chapter 2 is the literature review of the project. This chapter will explain about the research of the project chose and explained about the steering system of go kart. The basic components needed to build the steering system are also explained in this chapter.

Chapter 3 is the design concept and selection of this project. Its discuses about the data and information for get design. This chapter explain about to get the final design by using concept variants.

Chapter 4 is the fabrication process. It explains about to fabricate the product based on the final design and it consists of material selection.

Chapter 5 is the result and discussion. It explains about operating procedure to run the product and also discuss about the problem during fabrication process.

Chapter 6 is the last chapter for this project report. It covers the overall result of this project.

1.6 CONCLUSION

This chapter can give a clear brief about the project's objective and scope. For the fabrication of the steering system for electric go kart, the scopes are used to be the referral in order to achieve the required specification of the steering system itself.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter will explain about the research of the project that has been chosen and explained about the history of go kart. It will review the basic components of the system itself. This chapter also shows the research for the machinery that will be used for the fabrication process.

2.1 HISTORY OF GO KART

Art Ingels developed the first go-kart in 1956 in Los Angeles, California. Ingels was a race car builder for Kurtis Kraft, a race car designer and developer. In 1958, Go Kart Manufacturing Co. Inc. became the first company to manufacture and distribute go-karts. In 1959, McCullough was the first company to manufacture go-kart engines. The design of the first go kart is shown in Figure 2.1.

In the late 1940s and 1950s, the cost of automobile racing began to increase in the United States, and competitors were cutting back--even quitting auto racing altogether. The prices to attend a race increased as well, as many race car drivers and race car owners demanded a higher incentive to cover the cost and risk of their race cars. Fans were no longer purchasing tickets to attend these events. However, the recently introduced go-kart machine did not entail a high expense to compete. Many drivers satisfied their need to race by racing go-karts.

In 1957, the International Kart Federation, or IFK, began establishing rules for go-kart competitions. By 1960, go-kart racing began to appear at local tracks across the United States. Throughout the decade, new go-kart tracks surfaced in many different cities and states. Go-karts continued to evolve thanks to the innovation of builders and designers. Go-karts originally were simple and straightforward machines. Despite the advancement in styles, go-kart racing remains the least expensive form of professional auto racing.

Different forms of go kart racing materialized through the IKF, such as Sprint Racing, Shifter Karts, Road Racing Karts and Speedway Karts.

Figure 2.1: First go kart build by Art Ingels

Sources: http://rearenginekarts.com

2.2 BASIC COMPONENT OF STEERING SYSTEM FOR GO KART

2.2.1 Steering Column

The combination of parts connecting the steering wheel to the track rods is called steering column. The primary function, of steering column, is to transmit the turning moment of the steering wheel to the track rods. Therefore, steering column convert the rotary movement of the steering wheel in driver's hand into the angular turn of the front wheels on road. The steering column is shown in Figure 2.2.

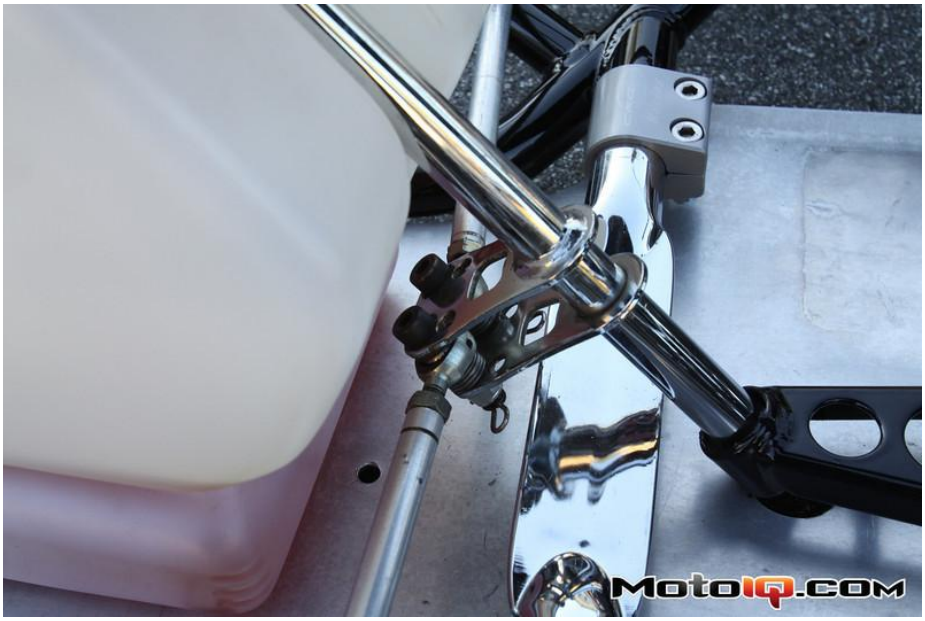

Figure 2.2: Steering Column

Source: http://www.motoiq.com

2.2.2 Track Rods and Ball Joint

A tubular track-rod spans the wheel track and pivots together the two stub-axles. The ends of this rod carry ball-joints, which in turn are bolted to the track-rod arms of each stub axle. These ball-joints are allowed to move only in the horizontal plane. The drag-link movement is either a pull or a push action and rotates one of the stub-axles. This motion is transferred to the other stub-axle through the track-rod. Figure 2.3 and Figure 2.4 had shown the track rods and the ball joint respectively. The function of the ball joint allows the wheels to swivel so the driver can steer. It is also a flexible joint with a ball and socket type. It is used for the steering knuckle.

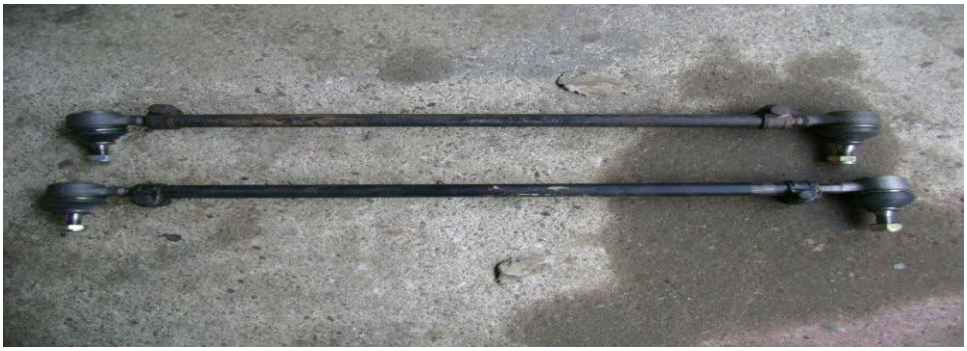

Figure 2.3: Track Rods

Source: http://transporterhaus.com

Figure 2.4: Ball Joint

Source: http://www.bizrice.com

2.2.3 Stub Axle

The stub-axle is a short axle-shaft to which one steered road-wheel is mounted. It uses two extended horizontal prongs that fit over the ends of the axle-beam. The king-pin, a short circular bar, passes vertically through both prongs and the eye of the axle-beam to form the hinge pivot. The stub-axle acts as the wheel axle as well as the pivot support member in the horizontal plane. Figure 2.5 show the example of stub axle.

Figure 2.5: Stub Axle

Source: http://www.motoiq.com

2.2.4 Steering Wheel

The steering wheel as shown in Figure 2.6 is the part of the steering system that is manipulated by the driver; the rest of the steering system responds to such driver inputs. This can be through direct mechanical contact as in recirculating ball or rack and pinion steering gears, without or with the assistance of hydraulic power steering, HPS, or as in some modern production cars with the assistance of computer controlled motors, known as Electric Power Steering.

Figure 2.6: Steering Wheel

Source: Wikipedia, Steering Wheel

2.3 MILLING PROCESS

Figure 2.7: Vertical Milling Machine

Source: Wikipedia, Milling Machine

A milling machine shown in Figure 2.7 is a machine tool used to machine solid materials. Milling machines are often classed in two basic forms, horizontal and vertical, which refer to the orientation of the main spindle. Both types range in size from small, bench-mounted devices to room-sized machines. Unlike a drill press, which holds the workpiece stationary as the drill moves axially to penetrate the material, milling machines also move the workpiece radially against the rotating milling cutter, which cuts on its sides as well as its tip. Workpiece and cutter movement are precisely controlled to less than 0.001 in (0.025 mm), usually by means of precision ground slides and lead screws or analogous technology. Milling machines may be manually operated, mechanically automated, or digitally automated via computer numerical control.

Milling machines can perform a vast number of operations, from simple (e.g., slot and keyway cutting, planing, drilling) to complex (e.g., contouring, die sinking). Cutting fluid is often pumped to the cutting site to cool and lubricate the cut and to wash away the resulting swarf.

2.4 TURNING PROCESS

A lathe shown in Figure 2.8 is a machine tool which turns cylindrical material, touches a cutting tool to it, and cuts the material. The lathe is one of the machine tools most well used by machining.

A material is firmly fixed to the chuck of a lathe. The lathe is switched on and the chuck is rotated. And since the table which fixed the byte can be moved in the vertical direction, and the right-and-left direction by operating some handles. It touches a byte's tip into the material by the operation, and make a mechanical part.

Figure 2.8: Lathe Machine

Source: http://www.nmri.go.jp

2.5 CONCLUSION

For this chapter, it can conclude that this chapter is a body of text that aims to review the knowledge before start this project. Besides, this chapter shows the project guidelines to accomplish this project successfully. More information is given on this project as a base for designing the steering system.

CHAPTER 3

DESIGN CONCEPT AND SELECTION

3.0 INTRODUCTION

This chapter consists of conceptual design, concept selection, and selection for the final design. It also explained about the concept selection and concept generation to get the final design.

3.1 DESIGN

The designs of the steering system must comply with several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspect that must be considered in designing the product is the ability of the system to steer the go kart. Another important criteria is the steering system fabricated should be fit with the chassis.

3.2 DRAWING

All the ideas for the steering system are sketched on the paper first to ensure that idea selection can be made. The final idea is drawn into the Solidworks 2009 drawing format with details features.